

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Previously Presented) A self-hydrating membrane electrode assembly (MEA) for fuel cells, wherein said MEA comprises:

(i) a cathode comprising an electrically conducting material having a catalytic material on a portion of a first surface thereof, said catalytic material comprising a catalytically effective amount of a mixture of at least one catalyst component and at least one ion conducting material to produce cations from a hydrogen-containing fuel supply;

(ii) an anode comprising an electrically conducting material having a catalytic material on a portion of a first surface thereof, said catalytic material comprising a catalytically effective amount of a mixture of at least one catalyst component and at least one ion conducting material to produce anions from an oxygen-containing fuel supply; and

(iii) a separator adjacent to and interposed between said cathode and said anode, said separator comprising an ion conducting material having a first surface and a second surface opposite said first surface, a portion of said first surface is adjacent to and in contact with said first surface of said cathode, and a portion of said second surface is adjacent to and in contact with said first surface of said anode;

wherein a portion of said first surface of said separator contacting said cathode is not in contact with said catalytic material on said cathode, a portion of said second surface of said separator contacting said anode is not in contact with said catalytic material on said anode, and said portions contacting said anode and said cathode without contacting said catalyst layers are opposite each other, thereby providing a portion of said separator that permits water to pass from the cathode side of said separator to the anode side of said separator, and

further wherein said cathode produces water in an amount effective to sustain hydration of said anode.

2. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 1, wherein said catalyst component comprise at least one member selected from the group consisting of platinum, palladium, nickel, iron, osmium, ruthenium, cobalt, gold, silver, copper, antimony, arsenic, molybdenum, tin, tungsten, alloys comprising one or more thereof, mixtures of two or more of said elements, mixtures of one or more of said elements and one or more alloys comprising one or more of said elements, and mixtures of alloys comprising one or more of said elements.

3. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 2, wherein said catalyst component on said cathode and said catalyst component on said anode are the same.

4. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 2, wherein said catalyst component on said cathode and said catalyst component on anode are not the same.

5. (Cancelled.)

6. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 1, wherein said ion conducting material comprises a perfluorinated sulfonic acid polymer.

7. (Withdrawn) The self-hydrating MEA of claim 2, wherein said catalytic material further comprises at least one modifying material.

8. (Withdrawn) The self-hydrating MEA of claim 7, wherein said modifying material affects at least one property of said catalytic material selected from the group consisting of hydrophilicity, hydrophobicity, organophobicity, organophilicity, surface charge, dielectric constant, porosity, gas exclusion, gas permeability, deliquescence, wetting, density, electron conductivity and ionic conductivity.

9. (Withdrawn) The self-hydrating MEA of claim of claim 7, wherein said modifying material comprises at least one polyalkylene or a derivative thereof.

10. (Withdrawn) The self-hydrating MEA of claim 9, wherein said polyalkylene is polyethylene.

11. (Withdrawn) The self-hydrating MEA of claim 9, wherein said derivative is a partially or fully fluorinated polyalkylene.

12. (Withdrawn) The self-hydrating MEA of claim 2, wherein said catalytic material further comprises a plurality of magnetic particles,

wherein each of said magnetic particles possesses a magnetic field of sufficient strength to alter the rate of and/or the distribution of products resulting from a chemical reaction involving said particle or occurring within the vicinity of said particle.

13. (Withdrawn) The self-hydrating MEA of claim 2, wherein said catalytic material further comprises a plurality of magnetizable particles,

wherein said magnetizable particles have been or are exposed to a magnetic field of sufficient strength for a sufficient time to align the magnetic moments of a portion of atoms at least some of said particles, and

further wherein said portion of atoms aligned within each of said particles is sufficient to alter the rate of and or the distribution of products resulting from a chemical reaction involving said particle or occurring within the vicinity of said particle.

14. (Withdrawn) The self-hydrating MEA of claim 13, wherein said alignment is maintained upon removal of said magnetic field.

15. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises a permanent magnetic material.

16. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises a paramagnetic material.

17. (Withdrawn) The self-hydrating MEA of claim 12 or 13, wherein each of said particles comprises a superparamagnetic material.

18. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises a ferromagnetic material.

19. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises a ferrimagnetic material.

20. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises a superconducting material.

21. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises an anti-ferromagnetic material.

22. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein said chemical reaction involves transfer of at least one subatomic particle.

23. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein said subatomic particle is selected from the group consisting of protons and electrons.

24. (Withdrawn) The self-hydrating MEA of 12, 13 or 14, wherein each of said particles has a diameter of about 0.1 microns to about 50 microns.

25. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles comprises at least one element selected from the group consisting of samarium, neodymium, iron, boron, lithium, manganese, nickel, cobalt and zinc.

26. (Withdrawn) The self-hydrating MEA of claim 12, 13 or 14, wherein each of said particles has at least one coating layer on at least a portion of the surface thereof.

27. (Withdrawn) The self-hydrating MEA of claim 26, wherein said coating layer comprises at least one inert material.

28. (Withdrawn) The self-hydrating MEA of claim 27, wherein said inert material comprises a silane or a silicon dioxide or a mixture thereof.

29. (Withdrawn) The self-hydrating MEA of claim 26, wherein said coating layer comprises at least one modifying material.

30. (Withdrawn) The self-hydrating MEA of claim 29, wherein said modifying material comprises at least one polymer.

31. (Withdrawn) The self-hydrating MEA of claim 30, wherein said polymer renders said particle chemically inert and/or mechanically stable.

32. (Withdrawn) The self-hydrating MEA of claim 29, wherein said modifying material affects at least one property of said particle selected from the group consisting of hydrophilicity, hydrophobicity, organophobicity, organophilicity, surface charge, dielectric constant, porosity, gas exclusion, gas permeability, deliquescence, wetting, density, electron conductivity and ionic conductivity.

33. (Withdrawn) The self-hydrating MEA of claim 29, wherein said modifying material is selected from the group consisting of homopolymers formed from the following monomers: styrene, styrene derivatives, 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, iso-decyl methacrylate, methyl methacrylate, methyl acrylate, vinyl acetate, ethylene glycol, ethylene, 1,3-dienes, vinyl halides, and vinyl esters.

34. (Withdrawn) The self-hydrating MEA of claim 29, wherein said modifying material is selected from the group consisting of copolymers formed from at least one Monomer A and at least one Monomer B, wherein said Monomer A is selected from the group consisting of styrene, methyl acrylate, iso-decyl methacrylate, 2-hydroxyethyl acrylate, and 2-hydroxyethyl methacrylate and said Monomer B is selected from the group consisting of 4-styrenesulfonic acid and ethylene glycol dimethacrylate.

35. (Withdrawn) The self-hydrating MEA of claim 26, wherein each of said particles has a plurality of coating layers.

36. (Withdrawn) The self-hydrating MEA of claim 29, wherein each of said particles has a plurality of coating layers.

37. (Withdrawn) The self-hydrating MEA of claim 36, wherein at least one of said plurality of coating layers comprises an inert material.

38. (Withdrawn) The self-hydrating MEA of claim 13, wherein said magnetic particle comprises at least one material selected from the group consisting of samarium cobalt, neodymiumiron-boron, iron and iron oxide, cobalt, misch metal, and ceramic magnets comprising barium ferrite and/or strontium ferrite.

39. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 1, wherein said separator comprises a polymer electrolyte membrane.

40. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein said polymer electrolyte membrane comprises at least one perfluorinated sulfonic acid polymer.

41. (Withdrawn) The self-hydrating MEA of claim 39, wherein said polymer electrolyte membrane has been subjected to at least one modifying process.

42. (Withdrawn) The self-hydrating MEA of claim 41, wherein said modifying process affects at least one property of said membrane selected from the group consisting of hydrophilicity, hydrophobicity, organophobicity, organophilicity, surface charge, dielectric constant, porosity, gas exclusion, gas permeability, deliquescence, wetting, density, electron conductivity and ionic conductivity.

43. (Withdrawn) The self-hydrating MEA of claim 41, wherein said modifying process enhances hydration of said membrane.

44. (Withdrawn) The self-hydrating MEA of claim 41, wherein said modifying process reduces the thickness of said membrane.

45. (Withdrawn) The self-hydrating MEA of claim 43 or 44, wherein said modifying process comprises contacting said membrane with an acidic solution at elevated temperature for a sufficient period of time.

46. (Withdrawn) The self-hydrating MEA of claim 45, wherein said acidic solution is at a temperature above ambient temperature.

47. (Withdrawn) The self-hydrating MEA of claim 46, wherein said acidic solution comprises a sulfuric acid solution.

48. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein the thickness of said polymer electrolyte membrane is less than 20 mils.

49. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein the thickness of said polymer electrolyte membrane is less than 7 mils.

50. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein the thickness of said polymer electrolyte membrane is less than 5 mils.

51. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein the thickness of said polymer electrolyte membrane is between 1 mil and 7 mils.

52. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein the thickness of said polymer electrolyte membrane is about 2 mils.

53. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 39, wherein the thickness of said polymer electrolyte membrane is about 1 mil.

54. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 12 or 13, wherein said chemical reaction involves the flux of a solute.

55. (Withdrawn) The self-hydrating MEA of claim 12 or 13, wherein said chemical reaction involves mass transport.

56. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 2, wherein said catalytic component is present in an amount between 0.1 and 0.8 mg/cm².

57. (Withdrawn) The self-hydrating MEA of claim 38, wherein said catalytic component is present in an amount of about 0.4 mg/cm².

58. (Withdrawn) The self-hydrating MEA of claim 12 or 13, wherein said particles are present in an amount between 0.1 and 0.8 mg/cm².

59. (Withdrawn) The self-hydrating MEA of claim 38, wherein said particles are present in an amount of about 0.4 mg/cm².

60. (Withdrawn) The self-hydrating MEA of claim 12 or 13, wherein said particles are present in said catalytic material on said cathode and said catalytic material on said anode.

61. (Withdrawn) The self-hydrating MEA of claim 12 or 13, wherein said particles are present only in said catalytic material on said cathode.

62. (Withdrawn) The self-hydrating MEA of claim 12 or 13, wherein said particles are present only in said catalytic material on said anode.

63. (Withdrawn) The self-hydrating MEA of claim 60, wherein said particles present in said catalytic material on said cathode are the same as said particles present in said catalytic material on said anode.

64. (Withdrawn) The self-hydrating MEA of claim 60, wherein said particles present in said catalytic material on said cathode are not the same as said particles present in said catalytic material on said anode.

65. (Withdrawn) The self-hydrating MEA of claim 1, further comprising (iv) a gasket or seal adjacent to and in substantial contact with said separator and that portion of said surface of said cathode and/or said anode that does not have said catalytic material thereon.

66. (Withdrawn) The self-hydrating MEA of claim 65, wherein the ratio of the external periphery of said gasket or seal to the internal periphery thereof to the length of an edge of said catalytic material on said first surface of said cathode is about 3:about 2:about 1.

67. (Withdrawn) The self-hydrating MEA of claim 65, wherein said gasket or seal contacts an edge of said catalytic material.

68. (Withdrawn) The self-hydrating MEA of claim 65, wherein said gasket or seal is in substantial contact with said separator and said cathode.

69. (Withdrawn) The self-hydrating MEA of claim 65, wherein said gasket or seal is in substantial contact with said separator and said anode.

70. (Withdrawn) The self-hydrating MEA of claim 65, wherein said gasket or seal is in substantial contact with said separator and said anode and said cathode.

71. (Withdrawn) The self-hydrating MEA of claim 65, wherein said gasket or seal comprises a polymer.

72. (Withdrawn) The self-hydrating MEA of claim 71, wherein said polymer comprises at least one member of the group consisting of fluoroelastomers, partially or fully fluorinated polyalkanes and natural and synthetic rubbers.

73. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 1, wherein the ion conducting material comprises one or more charge carriers.

74. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 1, wherein the ion conducting material comprises one or more ionic groups.

75. (Previously Presented) The self-hydrating membrane electrode assembly (MEA) of claim 1, wherein the cathode, the anode, or both comprise a layer of the catalytic material on at least a portion of the first surface thereof and the at least one ion conducting material is dispersed throughout the layer of the catalytic material.